

# **Impacts of Climate Change on Mountain Pine Beetle Habitat Suitability and Outbreak Risk in Whitebark Pine Forests of British Columbia**

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Populations of mountain pine beetle are currently at epidemic levels in British Columbia and observations suggest that infestations are occurring areas previously considered climatically unfavourable for brood development. Warming climates are expanding the northern limits of mountain pine beetle's range in British Columbia, and probably creating more suitable habitat for the establishment and persistence of beetle populations at higher elevations. This means that high-elevation whitebark pine forests may more vulnerable to beetle outbreaks than ever before. Whitebark pine is already declining due to white pine blister rust infections and forest management activities, and the added pressure of mountain pine beetle outbreaks is likely to exacerbate its decline, adversely affecting many ecosystem processes and posing a threat to animals that rely on its seed for food.

Little is known about the status of mountain pine beetle populations in whitebark pine forests of British Columbia. The objective of this work was to assess the potential impacts of climate change on the suitability of beetle habitats in whitebark pine forests. Based on empirical relationships of the direct and indirect influences of climate on mountain pine beetle, landscape-wide projections of climatically suitable beetle habitat have been constructed from 1921 to 2070 using historical weather records and future conditions predicted by the CGCM1 global circulation model, which assumes a doubling of atmospheric CO<sub>2</sub> by 2100. We overlaid these projections onto the geographic range of whitebark pine in British Columbia and quantified changes in the distribution of suitable beetle habitat and risk (very low, low, moderate, severe, extreme) of whitebark pine forests to beetle outbreaks. We found that warming climates are generating substantial changes in the risk of whitebark pine forests to beetle outbreaks. From 1921 to 1950, most whitebark pine forests were at very low risk to beetle outbreaks. However, between 1921 and 2070, there were substantial increases in the amount (ha) of whitebark pine forests at moderate and severe risk to beetle outbreaks, with the amount of whitebark pine forest at severe risk doubling between 2001 and 2070.